Numerical approach to investigation of electromagnetic wave interaction with heterogeneous biological structure

Dagmar Faktorová, Katarína Isteníková

Abstract. Scattering parameters in biological tissues are modelled in order that sufficient knowledge of electrical properties of biological materials and their interaction with electromagnetic waves may be obtained. Because of complex heterogeneous structure of biological tissues the electromagnetic field distribution in biological systems is very complicated and depends, among others, on the type of tissue and on the presence of complicated layered structures and interfaces. With the knowledge of these electrical properties the absorption of energy and the field distribution which are the results of the solution to a boundary value problem can be obtained and simulated.

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Transient analysis in pulsed eddy current evaluation of conductive materials

Milan Smetana, Ladislav Janoušek

Abstract. Transient analysis in pulsed eddy current evaluation of conductive materials is performed. Numerical simulations are carried out to study correlations between the driving and response signals regarding the defect classification. Various configurations of the excitation and the sensing systems are presented to achieve more complex information about the material defects.

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Combined optimal control technique for robot manipulators

Abbas Chatraei, Václav Záda

Abstract. A combined optimal control method for robot manipulators is presented. The approach includes iterative linearization (IL), iterative learning control (ILC) and parametric optimization. The robot is assumed to perform a repeated task such as pick and place parts in an assembly line. Accordingly, in each trial in which the robot performs the task, a linear time variant (LTV) version of its nonlinear dynamics model is obtained (using IL) and at the same time an optimal control input for this LTV is computed by a parametric optimization method. The optimal solution of each trial is stored in memory of the system to compute the optimal solution in the next trial (ILC). This procedure is repeated so that after a finite number of trials, the sequence of optimal solution of LTVs converges to the robot's optimal control input. Two outstanding features of this method consist in the fact that the optimal control problem is solved gradually during some trials while the time necessary to compute the optimal control input is divided into some trials, and that the optimal solution of each trial is used as the initial guess of the next optimization problem. Hence, the global optimal solution is finally achieved.

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Model of photovoltaic cell with consideration of load variability

Konrad Skowronek, Grzegorz Trzmiel

Abstract. A model of photovoltaic cell operation in real conditions is proposed. Its application allows determining the coefficients of models for faultless operation of the tested module. Approximation of a multivariable function has been used, with optimization consisting in minimization of the mean-square error. The method of residua estimation is applied, modified according to verification of the obtained models. The choice of the optimal model is the final aim of the paper.

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Simple design procedure for high-power three-phase inverters operating in PWM and six-step modes

Ahmed A. A. Hafez

Abstract. Simple analytical expressions for RMS, peak, and average currents in three-phase DC/AC inverter operating under different operating conditions are derived. The results are validated by rigorous simulation.

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Mixed mode oscillations and chaos in nonlinear circuits

Wieslaw Marszalek, Zdzislaw W. Trzaska

Abstract. Bifurcations of singularly perturbed electric circuits comprising resistor of cubic nonlinearity, capacitors, inductors and linear voltage (or current) sources are investigated. The above combination of elements provides very interesting results yielding an interplay between the typical relaxations and small amplitude oscillations, that is the mixed-mode oscillations. The dynamic properties of the circuits are characterized by the Farey sequence. Several results of numerical simulation carried out in MATLAB are presented.

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High efficient method for control chart patterns recognition

Ataollah Ebrahimzadeh, Vahid Ranaee

Abstract. An efficient automated method for control chart patterns recognition is presented. This method is based on a multi-class support vector machine based classifier for determining the membership of patterns. In order to find the best model of support vector machines, a genetic algorithm for optimization is used. Numerical results prove high accuracy of the proposed method.

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Free convection flow and heat transfer between two vertical parallel plates with variable temperature at one boundary

Marneni Narahari, Binay K. Dutta

Abstract. An exact solution to the problem of unsteady free convection flow and heat transfer in a viscous incompressible fluid between two long vertical parallel plates is presented. The temperature at one of the plates increases linearly with time while that at the other plate remains constant at the initial fluid temperature. The dimensionless governing equations are solved using Laplace transform technique. The solutions are obtained in the forms of rapidly converging infinite series. Computed velocity and temperature profiles as well as the shear stress and heat flux at the plates are presented. The parametric and temporal variations of the relevant quantities are discussed.

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Heat transfer analysis of unsteady flow over a porous stretching surface embedded in a porous medium in presence of thermal radiation

Swati Mukhopadhyay

Abstract. An analysis of the effects of thermal radiation on unsteady boundary layer flow and heat transfer over a porous stretching surface embedded in porous medium is performed. The fluid is assumed to be viscous and incompressible. Numerical computations are carried out for different values of the parameters involved in this study and the analysis of the results obtained shows that the flow field is influenced appreciably by the unsteadiness parameter, parameter of the porous medium and thermal radiation and suction at the surface. With increasing values of the unsteadiness parameter, fluid velocity and temperature are found to decrease in both cases of porous and non-porous media. The fluid velocity decreases due to increasing values of the parameter of the porous medium, which results in an increase of the temperature in both steady and unsteady cases.

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